Space Weather Technical Forecast

Issued on Thursday 20 February 2025 at 12:17 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares. Possible glancing CME day 4 (23 Feb)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C8.1 at 19/2345 UTC from ex-AR3991 in the southwest. There are seven sunspot regions on the visible disc, however most of these are relatively small and simple, with little growth or development observed. The most notable regions are the moderately large AR3998 and AR3996 in the southeast, both have exhibited some mixed magnetic complexity, with an increase in flare activity in recent hours.

A CME followed the aforementioned C8 flare with modelling results indicating a chance of a glancing blow on day 4 (23 Feb). Additionally a filament was observed to lift off from the southeast, beginning around 20/0500UTC, with a narrow, south directed CME now visible in imagery. Modelling results are pending, however it looks directed well below Earth orbit. Most recently, flaring in the vicinity of AR3996, now approaching centre disc, may have produced a new CME, but updated imagery is awaited to more fully assess.

Solar Wind / Geomagnetic Activity: Solar winds showed the tail end of coronal hole 15, with perhaps an additional enhancement from one or more weak CME glances. Solar winds, as measured by ACE and DSCOVER at L1 were slightly elevated and mainly in the range 450-500km/s. Density was variable at ACE through the morning, but otherwise mainly at or below average. Interplanetary Magnetic Field, Bt, was Weak at 8nT or less. The north-south component was mainly negative (southward) with peak -7nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Unsettled to Active (Kp 3-4) between 19/1800-20/0600 UTC, otherwise Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 persisted at Background. High energy electron flux (greater than 2MeV) at GOES16 was Moderate, peaking at 305pfu at 19/2120UTC. The associated 24-hour fluence was below the Active threshold (1e8 integrated pfu), with the 20/0000UTC observation being 1.23e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be generally Low, with a chance of isolated M-class flares.

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Solar Wind / Geomagnetic Activity:

A CME followed a C8 flare at 19/2345 UTC from a now decayed region in the southwest, with modelling results indicating a chance of a glancing blow around the middle of the day (UTC) on day 4 (23 Feb).

Solar winds are still currently slightly elevated, after the recent enhancement from CH15/-, which is no longer visible on the Earth-facing disc. No further enhancements are expected in the next few days with a gradual easing trend expected for the solar wind, perhaps falling to background by the end of the period. However, on day 4 (23 Feb) there is a chance of a glancing CME as mentioned above. Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled intervals, and a slight chance of Active intervals, mainly early in the period. On day 4 (23 Feb) there is a chance for an increase to G1/Minor Storm levels due to a possible glancing CME.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background. High energy flux is expected to be mainly Moderate, with a slight chance of rising to High at first, but with an overall declining trend towards background. The associated 24 hour fluence is expected to remain below Active.

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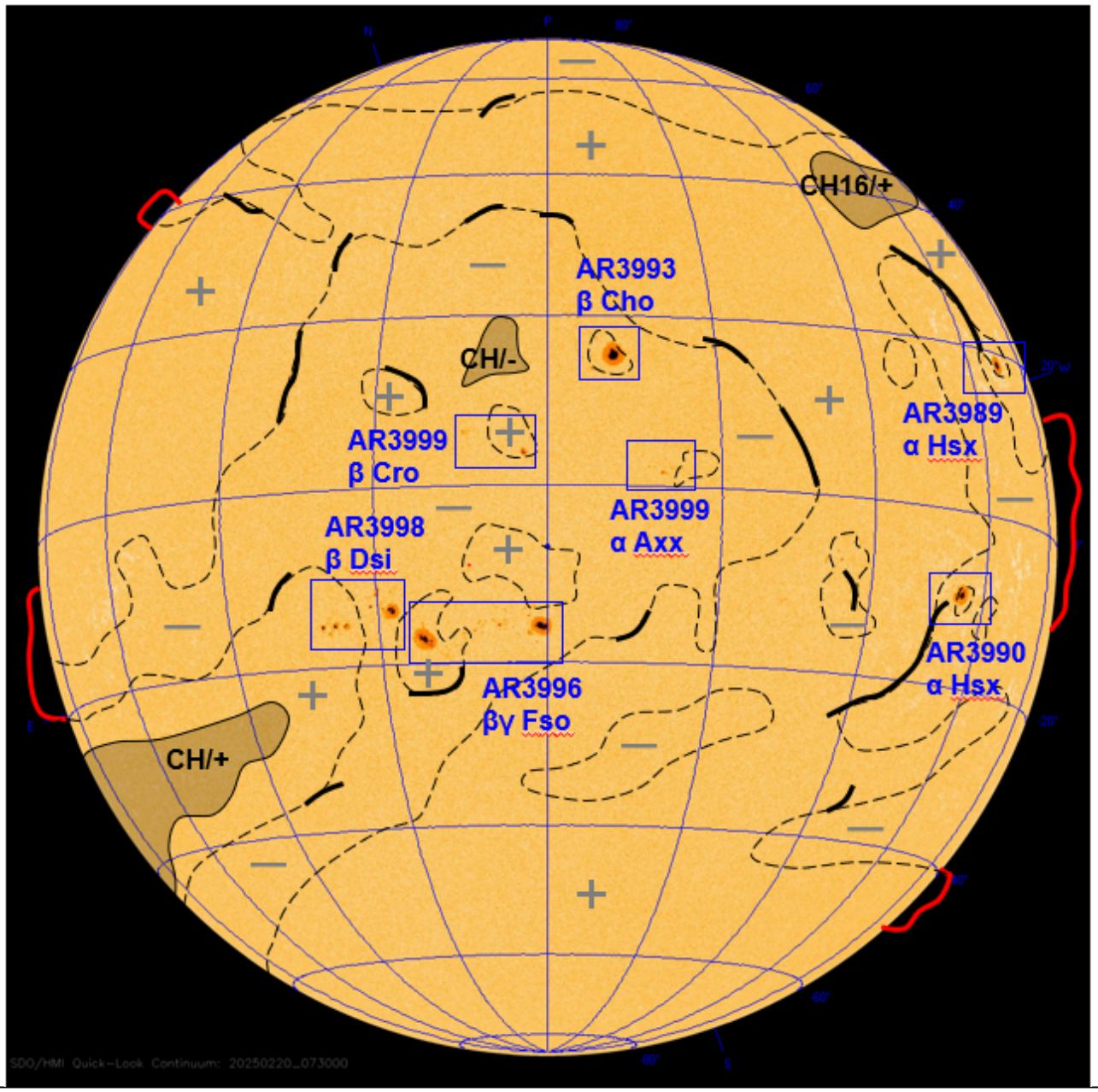
Figure 1: MOSWOC Solar Synoptic Map 20/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A CME followed a C8 flare at 19/2345 UTC from a now decayed region in the southwest, with modelling results indicating a chance of a glancing blow around the middle of the day (UTC) on day 4 (23 Feb). Additionally a filament was observed to lift off from the southeast, beginning around 20/0500UTC, with a narrow, south directed CME now visible in imagery. Modelling results are pending, however it looks directed well below Earth orbit. Most recently, flaring in the vicinity of AR3996, now approaching centre disc, may have produced a new CME, but updated imagery is awaited to more fully assess.

Solar winds are still currently slightly elevated, after the recent enhancement from CH15/-, which is no longer visible on the Earth-facing disc. No further enhancements are expected in the next few days with a gradual easing trend expected for the solar wind, perhaps falling to background by the end of the period. However, on day 4 (23 Feb) there is a chance of a glancing CME as mentioned above. Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled intervals, and a slight chance of Active intervals, mainly early in the period. On day 4 (23 Feb) there is a chance for an increase to G1/Minor Storm levels due to a possible glancing CME.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	30
Strong	G3	No	1	1	1	5
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
20/0514	Partial	ex-AR3991	SW	438	23/1200UTC +/-6 hours	Chance of a glancing blow.

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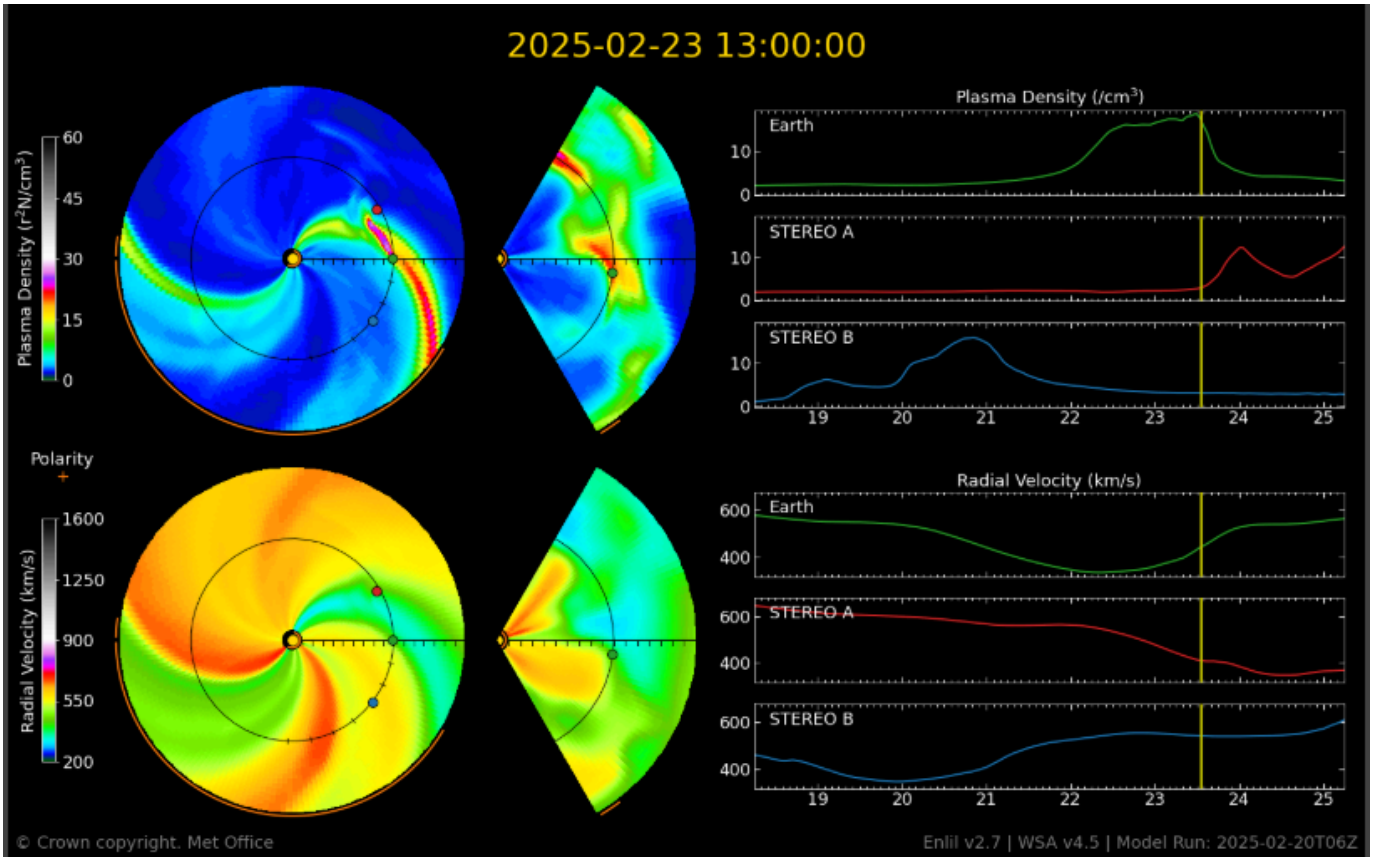
Figure 2: MOSWOC Enlil. Possible glancing CME on 23 Feb.



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Radio Blackouts - X-Ray Flares

Low solar activity is forecast with a chance of rising to Moderate with isolated M-class flares possible.

There are seven sunspot regions on the visible disc, however most of these are relatively small and simple, with little growth or development observed. The most notable regions are the moderately large AR3998 and AR3996 in the southeast, both have exhibited some mixed magnetic complexity, with an increase in flare activity in recent hours. There is also perhaps a new region potentially moving onto the northeast limb, however this may take a further day or two to be visible.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

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Solar Radiation Storms (High Energy Protons)

GOES18 high energy proton flux is most likely to persist at background levels. The sunspot regions currently in the western disc are unlikely to produce flares that would result in the release of Earth-directed high energy protons, however as AR3996 and AR3998 transit westward through the period this risk increases slightly.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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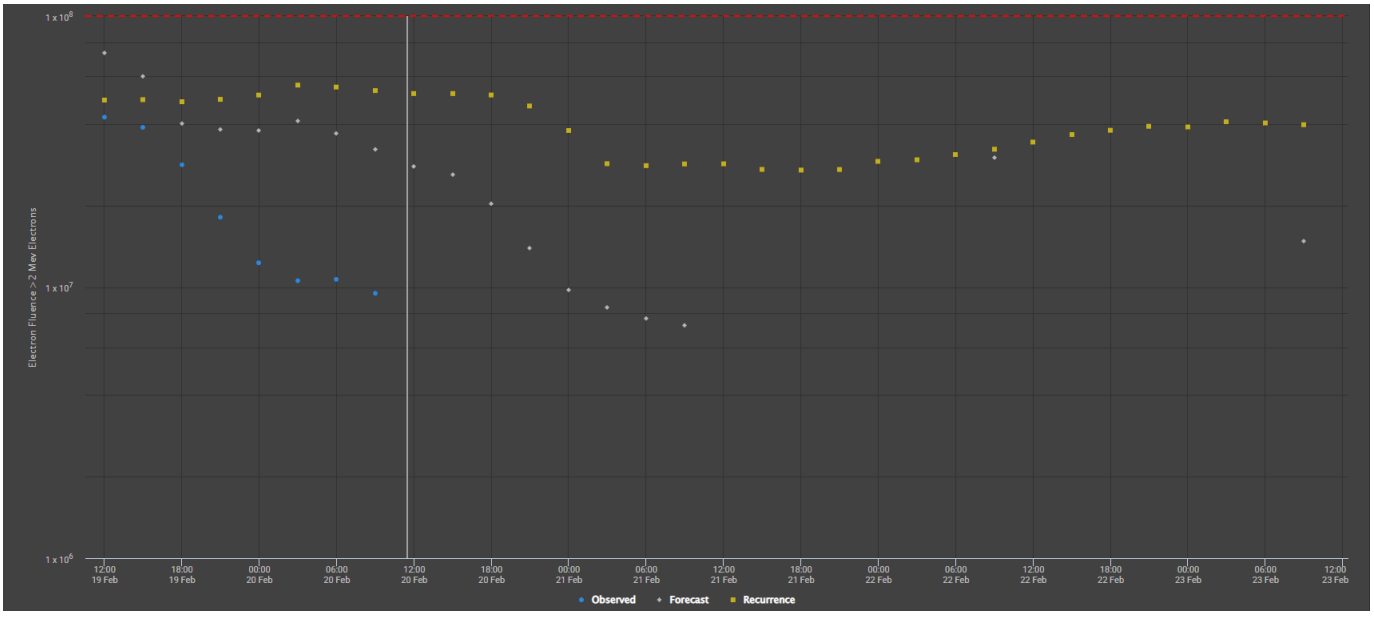
High Energy Electrons (≥ 2MeV)

High energy electron flux, as observed at GOES-16 is now at persistently Moderate, after the recent glancing CME enhancement on 18-19 Feb likely resulted in a drop out of the charge through the Van Allen Belt. As solar winds ease, the observed flux at GEO may rise still rise a little, with a chance of reaching a diurnal high peak 20-21 Feb (Day 1-2) , however this is expected to only be short-lived, with a declining trend more likely, especially day 3-4 (21-22 Feb).

The associated 24 hour fluence is currently below the Active level, and expected to persist below this level, with a likely declining trend, particularly by day 3-4 (22-23 Feb).

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 3: MOSWOC REFM



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